

Having thus described the preferred embodiment, the invention is now claimed to be:

1. A package mounting integrated circuit chips onto a circuit board comprising:

55 an integrated circuit chip having a surface array of input/output pads on one side thereof which array forms a footprint;

60 a chip carrier formed of an organic glass filled epoxy dielectric material having first and second opposite surfaces;

65 said chip carrier having a coefficient of thermal expansion of at least 17×10^{-6} ppm/c°;

a first set of bonding pads formed on said first surface of the chip carrier and arranged in an array corresponding with the chip footprint;

a pattern of conductors on said chip carrier connected to accommodate said input/output pads;

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a first set of solder connections interconnecting the input/output pads on the chip to said first set of bonding pads on the chip carrier;

an encapsulation material encapsulating said first set of solder connections;

a second set of bonding pads formed on the second surface of the chip carrier arranged in an array;

electrically conducting vias extend through the chip carrier connecting said first set of bonding pads to the second set of bonding pads;

a circuit board formed of an organic material having a coefficient of thermal expansion similar to the chip carrier;

a set of electrical connection sites formed on said circuit board and arranged in a pattern corresponding to the pattern of the array of the second bonding pads on said chip carrier;

a second set of solder connections interconnecting the pads of said second set of bonding pads on the chip carrier to the connection sites on the circuit board; and wiring on said circuit board connected to said second set of bonding pads.

2. The package of claim 1 wherein said chip carrier and said circuit board are formed of the same material.

3. The package as defined in claim 1 wherein said first set of solder connections is formed of a higher melting point solder than said second set of solder connections.

4. The package as defined in claim 1 further characterized by first bonding pads being more closely spaced to each other than said second bonding pads.

5. The package as defined in claim 1 wherein the thermal coefficient of expansions of the material of the chip carrier and the material of the circuit board do not differ by more than about 20%.

6. The package as defined in claim 1 wherein the thickness of the conductors on said chip carrier is thinner than the wires of the wiring on the circuit board.

7. A method of mounting integrated circuit chips onto a circuit board comprising the steps of:

providing an integrated circuit chip having a surface array of input/output pads on one side thereof which array forms a footprint;

providing a chip carrier formed of an organic glass filled epoxy dielectric material having first and second opposite surfaces;

said chip carrier having a coefficient of thermal expansion of at least 17×10^{-6} ppm/c°;

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forming a first set of bonding pads on said first surface of the chip carrier arranged in an array corresponding with the chip footprint;

5 providing a pattern of conductors on said chip carrier connected to accommodate said input/output pads;

forming a first set of solder connections between the input/output pads on the chip and said first set of bonding pads on the chip carrier;

10 an encapsulation material encapsulating said first set of solder connections;

forming a second set of bonding pads on the second surface of the chip carrier arranged in an array;

15 forming electrically conducting vias through the chip carrier to connect said first set of bonding pads to the second set of bonding pads;

providing a circuit board formed of an organic material having a coefficient of thermal expansion similar to the chip carrier;

20 forming a set of electrical connection sites on said circuit board arranged in a pattern corresponding to the pattern of the array of the second bonding pads on said chip carrier;

25 forming a second set of solder connections between the pads of said second set of bonding pads on the chip carrier and the connection sites on the circuit board; and

30 forming wiring on said circuit board connected to said second set of bonding pads.

8. The method of claim 7 wherein said chip carrier and said circuit board are formed of the same material.

9. The method as defined in claim 7 wherein said first set of solder connections is formed of a higher melting point solder than said second set of solder connections.

35 10. The method as defined in claim 7 further characterized by first bonding pads being more closely spaced to each other than said second bonding pads.

40 11. The method as defined in claim 7 wherein the thermal coefficient of expansions of the material of the chip carrier and the material of the circuit board do not differ by more than about 20%.

45 12. The package as defined in claim 7 wherein the thickness of the conductors on said chip carrier is thinner than the wires of the wiring on the circuit board.

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1 13. A package mounting integrated circuit chips onto a
2 circuit board comprising:

3 an integrated circuit chip having a surface array of
4 input/output pads on one side thereof which array forms a
5 footprint;

6 a chip carrier formed of an organic dielectric material
7 and having first and second opposite surfaces;

8 said chip carrier having a coefficient of thermal
9 expansion of at least about 15×10^{-6} ppm/C°;

10 a first set of bonding pads formed on said first
11 surface of the chip carrier and arranged in an array
12 corresponding with the chip footprint;

13 a pattern of conductors on said chip carrier connected
14 to accommodate said input/output pads;

15 a first set of solder connections interconnecting the
16 input/output pads on the chip to said first set of bonding pads
17 on the chip carrier;

18 an encapsulation material encapsulating said first set
19 of solder connections;

20 a second set of bonding pads formed on the second
21 surface of the chip carrier arranged in an array;

22 electrically conducting vias extend through the chip
23 carrier connecting said first set of bonding pads to the second
24 set of bonding pads;

25 a circuit board formed of an organic material having a
26 coefficient of thermal expansion similar to the chip carrier;

27 a set of electrical connection sites formed on said
28 circuit board and arranged in a pattern corresponding to the
29 pattern of the array of the second bonding pads on said chip
30 carrier;

31 a second set of solder connections interconnecting the
32 pads of said second set of bonding pads on the chip carrier to
33 the connection sites on the circuit board; and

34 wiring on said circuit board connected to said second
35 set of bonding pads.

1 14. A package according to claim 13 wherein said chip
2 carrier has a coefficient of thermal expansion of at least about
3 16×10^{-6} ppm/C°.

1 15. A package according to claim 13 wherein said chip
2 carrier is formed of a glass filled epoxy.

1 16. A package mounting integrated circuit chips onto an
2 organic dielectric circuit board having a coefficient of thermal
3 expansion of at least about 15×10^{-6} ppm/°C, comprising:

an integrated circuit chip having a surface array of
input/output pads on one side thereof which array forms a
footprint;

a chip carrier formed of an organic dielectric material
[formed of an organic dielectric material] having a coefficient of
thermal expansion similar to the chip [carrier] and having first
and second opposite surfaces

a first set of bonding pads formed on said first surface of the chip carrier and arranged in an array corresponding with the chip footprint;

a pattern of conductors on said chip carrier connected to accommodate said input/output pads;

a first set of solder connections interconnecting the
input/output pads on the chip to said first set of bonding pads
on the chip carrier;

an encapsulation material encapsulating said first set
of solder connections;

a second set of bonding pads formed on the second surface of the chip carrier arranged in an array;

23 electrically conducting vias extend through the chip
24 carrier connecting said first set of bonding pads to the second
25 set of bonding pads;

26 a set of electrical connection sites formed on said
27 circuit board and arranged in a pattern corresponding to the
28 pattern of the array of the second bonding pads on said chip
29 carrier;

30 30nd a second set of solder connections interconnecting the
31 pads of said second set of bonding pads on the chip carrier to
32 the connection sites on the circuit board and
33 wiring on said circuit board connected to said second
34 set of bonding pads.

1 17. A package according to claim 16 wherein the thermal
2 coefficient of expansion of the material of the chip carrier and
3 the material of the circuit board do not differ by (more than)
4 about 20%.

1 18. A package according to claim 16 wherein said chip
2 carrier and said circuit board are formed of the same material.

1 19. A package according to claim 16 wherein said chip
2 carrier is formed of a glass filled epoxy.

1 20. A package according to claim 16 wherein said chip
2 carrier has a coefficient of thermal expansion of at least about
3 16×10^{-6} ppm/C°.

1 21. A package mounting integrated circuit chips onto a
2 circuit board comprising:

3 an integrated circuit chip having a surface array of
4 input/output pads on one side thereof which array forms a
5 footprint;

6 a chip carrier formed of an organic dielectric material
7 having first and second opposite surfaces;

8 a first set of bonding pads formed on said first
9 surface of the chip carrier and arranged in an array
10 corresponding with the chip footprint;

11 a pattern of conductors on said chip carrier connected
12 to accommodate said input/output pads;

13 a first set of solder connections interconnecting the
14 input/output pads on the chip to said first set of bonding pads
15 on the chip carrier;

16 an encapsulation material encapsulating said first set
17 of solder connections;

18 a second set of bonding pads formed on the second
19 surface of the chip carrier arranged in an array;

20 electrically conducting vias extend through the chip
21 carrier connecting said first set of bonding pads to the second
22 set of bonding pads;

23 a circuit board formed of an organic material having a
24 coefficient of thermal expansion similar to the chip carrier;

25 a set of electrical connection sites formed on said
26 circuit board and arranged in a pattern corresponding to the
27 pattern of the array of the second bonding pads on said chip
28 carrier;

29 a second set of solder connections interconnecting the
30 pads of said second set of bonding pads on the chip carrier to
31 the connection sites on the circuit board; and

32 wiring on said circuit board connected to said second
33 set of bonding pads.

1 22. A package according to claim 21 wherein the thermal
2 coefficient of expansions of the material of the chip carrier and
3 the material of the circuit board do not differ by more than
4 about 20%.

1 23. The package of claim 21 wherein said chip carrier and
2 said circuit board are formed of the same material.

1 24. A package according to claim 21 wherein said chip
2 carrier is formed of a glass filled epoxy.

1 25. A package according to claim 21 wherein said chip
2 carrier is formed of a polyimide.

1 26. A method of mounting integrated circuit chips onto a
2 circuit board comprising the steps of:

3 providing an integrated circuit chip having a surface
4 array of input/output pads on one side thereof which array forms
5 a footprint;

6 providing a chip carrier formed of an organic
7 dielectric material having a coefficient of thermal expansion of
8 at least about 15×10^{-6} ppm/c°, and having first and second
9 opposite surfaces;

10 forming a first set of bonding pads on said first
11 surface of the chip carrier arranged in an array corresponding
12 with the chip footprint;

13 providing a pattern of conductors on said chip carrier
14 connected to accommodate said input/output pads;

15 forming a first set of solder connections between the
16 input/output pads on the chip and said first set of bonding pads
17 on the chip carrier;

18 encapsulating said first set of solder connections;

19 forming a second set of bonding pads on the second
20 surface of the chip carrier arranged in an array;
21 forming electrically conducting vias through the chip
22 carrier to connect said first set of bonding pads to the second
23 set of bonding pads;
24 providing a circuit board formed of an organic material
25 having a coefficient of thermal expansion similar to the chip
26 carrier;
27 forming a set of electrical connection sites on said
28 circuit board arranged in a pattern corresponding to the pattern
29 of the array of the second bonding pads on said chip carrier;
30 forming a second set of solder connections between the
31 pads of said second set of bonding pads on the chip carrier and
32 the connection sites on the circuit board; and
33 forming wiring on said circuit board connected to said
34 second set of bonding pads.

1 27. The method of claim 26 wherein said chip carrier and
2 said circuit board are formed of the same material.

1 28. The method as defined in claim 26 wherein the thermal
2 coefficient of expansions of the material of the chip carrier and
3 the material of the circuit board do not differ by more than
4 about 20%.

1 29. A method of mounting integrated circuit chips onto an
2 organic dielectric circuit board having a coefficient of thermal
3 expansion of at least about 15×10^{-6} ppm/C° comprising the steps
4 of:

5 providing an integrated circuit chip having a surface
6 array of input/output pads on one side thereof which array forms
7 a footprint;

8 providing a chip carrier formed of an organic
9 dielectric material having a coefficient of thermal expansion
10 similar to the circuit board, said chip carrier having first and
11 second opposite surfaces;

12 forming a first set of bonding pads on said first
13 surface of the chip carrier arranged in an array corresponding
14 with the chip footprint;

15 providing a pattern of conductors on said chip carrier
16 connected to accommodate said input/output pads;

17 forming a first set of solder connections between the
18 input/output pads on the chip and said first set of bonding pads
19 on the chip carrier;

20 encapsulating said first set of solder connections with
21 an encapsulation material;

22 forming a second set of bonding pads on the second
23 surface of the chip carrier arranged in an array;

24 forming electrically conducting vias through the chip
25 carrier to connect said first set of bonding pads to the second
26 set of bonding pads;

27 forming a set of electrical connection sites on said
28 circuit board arranged in a pattern corresponding to the pattern
29 of the array of the second bonding pads on said chip carrier;

30 forming a second set of solder connections between the
31 pads of said second set of bonding pads on the chip carrier and
32 the connection sites on the circuit board; and

33 forming wiring on said circuit board connected to said
34 second set of bonding pads.

30. A method according to claim 29 wherein said chip
carrier has a coefficient of thermal expansion of at least about

$$16 \times 10^{-6} \text{ ppm/C}^\circ$$

1 31. A method according to claim 29 wherein said chip
2 carrier has a coefficient of thermal expansion of at least about
3 17×10^{-6} ppm/C°.

1 32. A method according to claim 29 wherein said chip
2 carrier is formed of a glass filled epoxy.

1 33. A method according to claim 29 wherein said chip
2 carrier is formed of a polyimide.

1 34. A method of mounting integrated circuit chips onto a
2 circuit board comprising:

3 providing an integrated circuit chip having a surface
4 array of input/output pads on one side thereof which array forms
5 a footprint;

6 providing a chip carrier formed of an organic
7 dielectric material having first and second opposite surfaces;
8 forming a first set of bonding pads formed on said
9 first surface of the chip carrier and arranged in an array
10 corresponding with the chip footprint;

11 providing a pattern of conductors on said chip carrier
12 connected to accommodate said input/output pads;

13 forming a first set of solder connections
14 interconnecting the input/output pads on the chip to said first
15 set of bonding pads on the chip carrier;

16 encapsulating said first set of solder connections;
17 forming a second set of bonding pads formed on the
18 second surface of the chip carrier arranged in an array;
19 forming electrically conducting vias extend through the
20 chip carrier connecting said first set of bonding pads to the
21 second set of bonding pads;

22 providing a circuit board formed of an organic material
23 having a coefficient of thermal expansion similar to the chip
24 carrier;

25 forming a set of electrical connection sites on said
26 circuit board and arranged in a pattern corresponding to the
27 pattern of the array of the second bonding pads on said chip
28 carrier;

29 forming a second set of solder connections
30 interconnecting the pads of said second set of bonding pads on
31 the chip carrier to the connection sites on the circuit board;
32 and

33 forming wiring on said circuit board connected to said
34 second set of bonding pads.